UPPER TRISHULI-1 HEP (216MW)			
Client	Nepal Water and Energy Development Company Private Limited		
Owner's Engineer	Tractebel Engineering GmbH / Jade Consult		
Contractor	Doosan Enerbility		
REPLY COMMENT			
Subcontractor	Power Construction Corporation of China		
Incoming Document			
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Background

On 29 December 2022 the Contractor has submitted for review to the OE the revised document NUMERICAL ANALYSIS FOR HYDRAULIC PERFORMANCE AND SEDIMENT DEPOSITION OF DESANDER BASIN (UT1-C-O30-CVL-DC-52003). The Owner's Engineer has reviewed the revised document and commented in his review note RN-0422 dated 07 January 2023. On 18 January 2023 the Contractor submitted his revised document. Related detailed review comments are given below.

Reply: The review comments given by the Owner's Engineer are very much appreciated. The authors have carefully considered the comments and revised the document NUMERICAL ANALYSIS FOR HYDRAULIC PERFORMANCE AND SEDIMENT DEPOSITION OF DESANDER BASIN (UT1-C-030-CVL-DC-52003) to Rev.C wherever appropriate. The following is written in response to the review comments. For convenience, the authors' responses are set in blue, while comments by Owner's Engineer are in black.

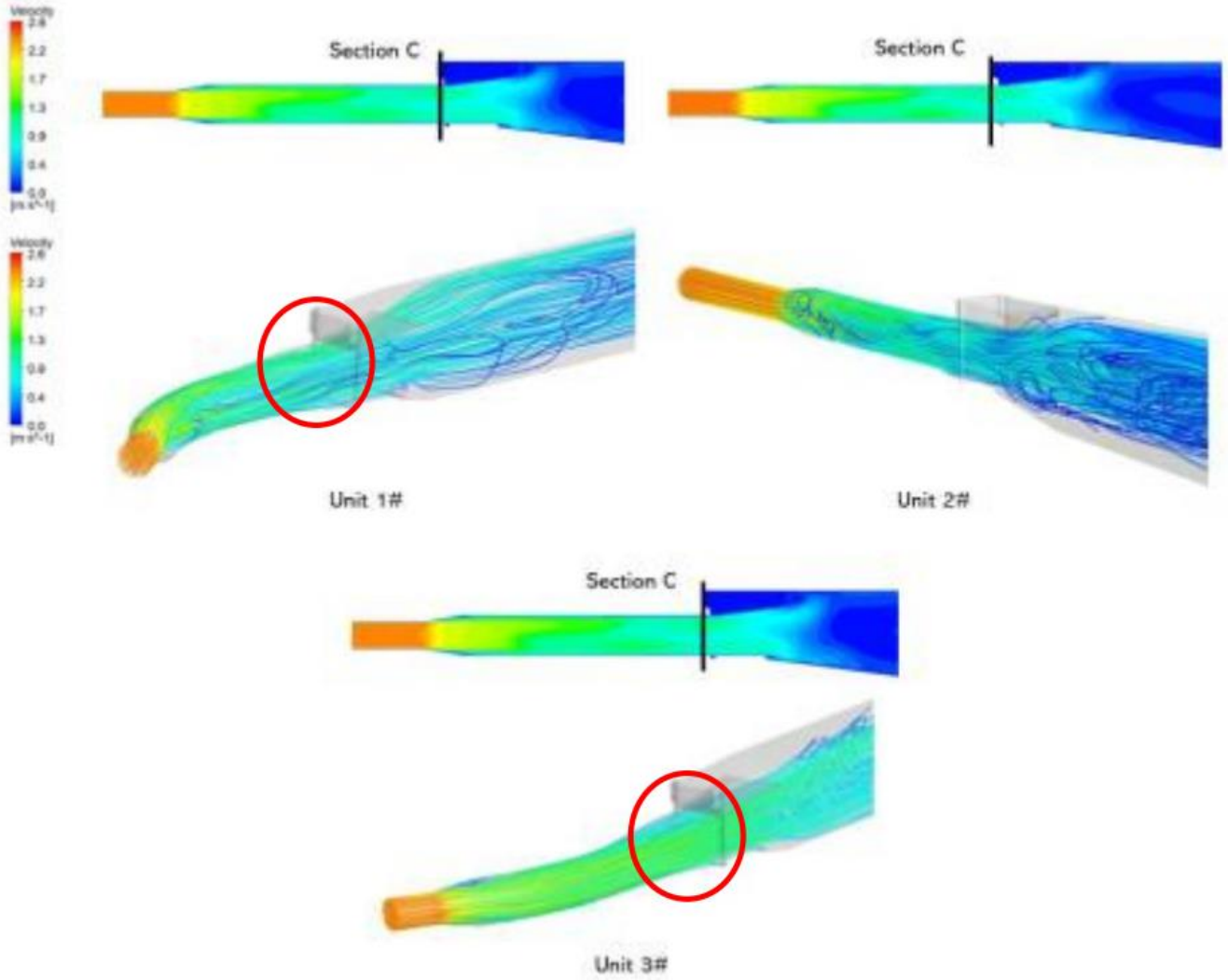
Comments:

Chapter 3.2.2 Flow pattern, para(2) The inlets of desander basins

The velocity distribution at the start of the inlet section (Section C) is different at the three desander basins. While the vertical velocity distribution appears to be relatively uniform across the entire depth, the horizontal velocity distribution appears to be uniform only for the central desander (Unit #2) while left and right desander basins (Unit #1 and Unit #3) have higher velocities at the outside and lower velocities at

the inside.

The values which can be derived from the figure included in the document (and for ease of reference repeated in this review note below) - based on the color code - are between **1.3 m/s** and **1.7 m/s** on the outside of the bend and between **0.4 m/s** and **0.9 m/s** on the inside of the bend.



This **skewness** in the **velocity distribution** at the beginning of the transition or 'Diffusion section' will result in lower effective length in the desander on the outside of the desanding basin.

" ... *the tiny differences of the three inlet velocity distributions can be neglected in the view of engineers.*"

The OE agrees that the differences between the three desanding basins are of smaller size. However, the **flow velocities** at the **inside** and **outside** of the related bend are **significantly different** (as much as this information can be derived from the color code and the figure included in the documentation). These **differences** are **not tiny**, and therefore cannot be neglected.

Reply: The below Fig.2 shows the velocity distributions at the starts of the inlet sections (location shown in Fig.1) at the desander basins of unit 1# and unit 3#. The values can be derived from the figure based on the color code. The velocity on the outside of the bend is larger with a value of 1.201 m/s of unit 1# and 1.230m/s of unit 3#. The v_{max}/ v_{min} is about 3.

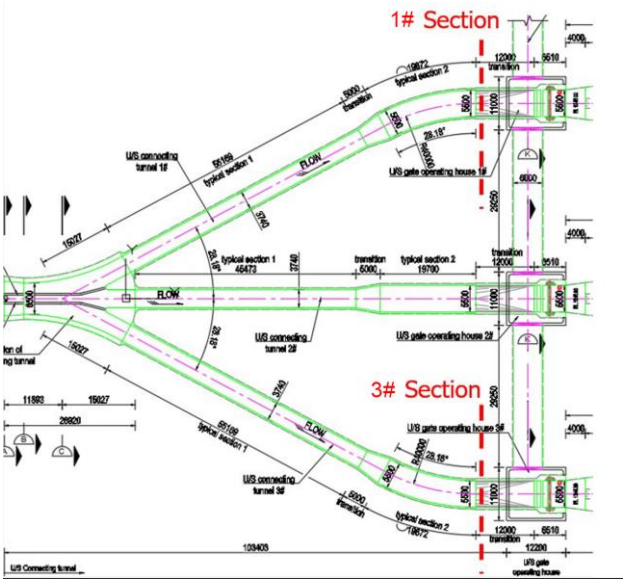


Fig.1 Location of the inlet sections

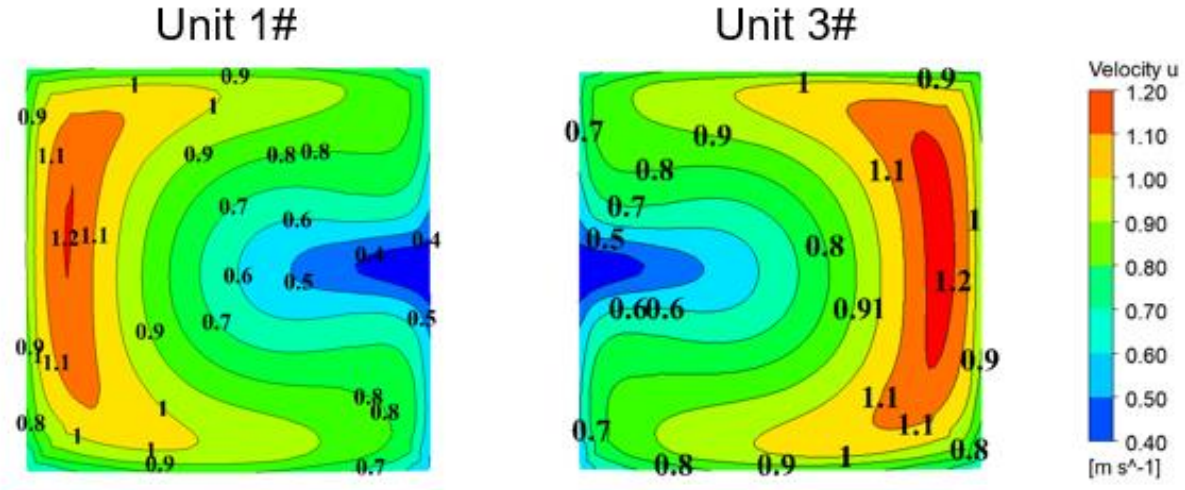


Fig.2 The velocity distributions at the inlet sections of the desander basins (Unit 1# and Unit 3#)

Chapter 4.3 Boundary condition and initial condition

" ..*It is worth noting that due to the fixed fomat of the software, the inlet boundary flow velocity can only beuniformly distributed*. ...".

In the sedimentation model, the flow velocity distribution at the initial section of the desander basin should reflect the results of the hydraulic optimisation carried out as first stage (ref. chapter 3.3 to 3.5), which describes the velocity distribution as non-uniform (see figure and velocities indicated by colour coding above). It is observed that

- flow conditions at the inlet section of the desander basin have been simulated with the hydraulicmodel, and
- these results are not similar to the uniform velocity distribution considered at the beginning of the simulation by FLOW-3D software,

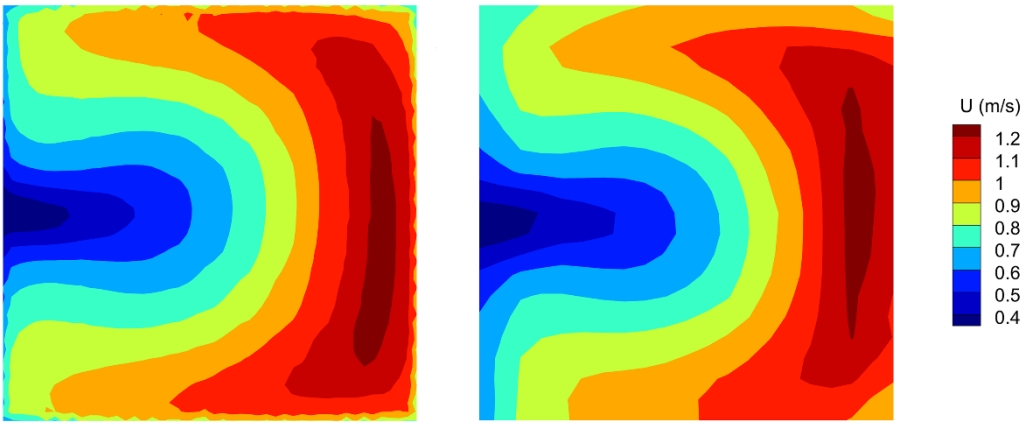
Therefore, the OE is of the view that the **length of the 'Diffusion section'** should be **extended** by an appropriate length to take account of the non-uniform flow conditions at the start of the diffusion section.

Or the **numerical simulation** should **document** that the flow velocity distribution in each of the desander basins is **quasi uniform** at the start of some 30 m long 'Diffusion section' in order to achieve a 30 m long effective transition upstream of the actual working section of the desander.

Reply: In order to reflect the results of the first stage - Inflow Hydraulic Performance, we have implemented a secondary development of FLOW-3D to use the flow distribution from the first stage of the hydraulic calculations as a boundary condition for the sedimentation calculations, see Fig.3. A new case involving this non-uniform inflow boundary was calculated and compared with the previous case, see Tab. 1. Note that these two cases are only different in the inflow velocity distribution.

Tab.1 Cases to compare

Case	Inflow velocity	Working section length (m)	Diffusion section length (m)
New case	Non-uniform	110	33.5
Previous case	Uniform	110	33.5



(a) carried out in first stage (b) set in sedimentation model

Fig.3 Comparison of the inlet velocity distribution of the sedimentation calculation with the hydraulic calculation

If the sedimentation efficiency of d = 0.2 mm and coarser obtained from the non-uniform inflow calculation can reach and exceed 90% at the 110m section and is not significantly different from the uniform inflow result, then our previous calculation results are valid and length of the 'Diffusion section' doesn't need an extension.

The bed morphology of the previous calculations using uniform flow and the current case using non-uniform flow is shown in Fig.4. The effect of the flow velocity distribution at the inlet on the morphology is rather limited and thus negligible.

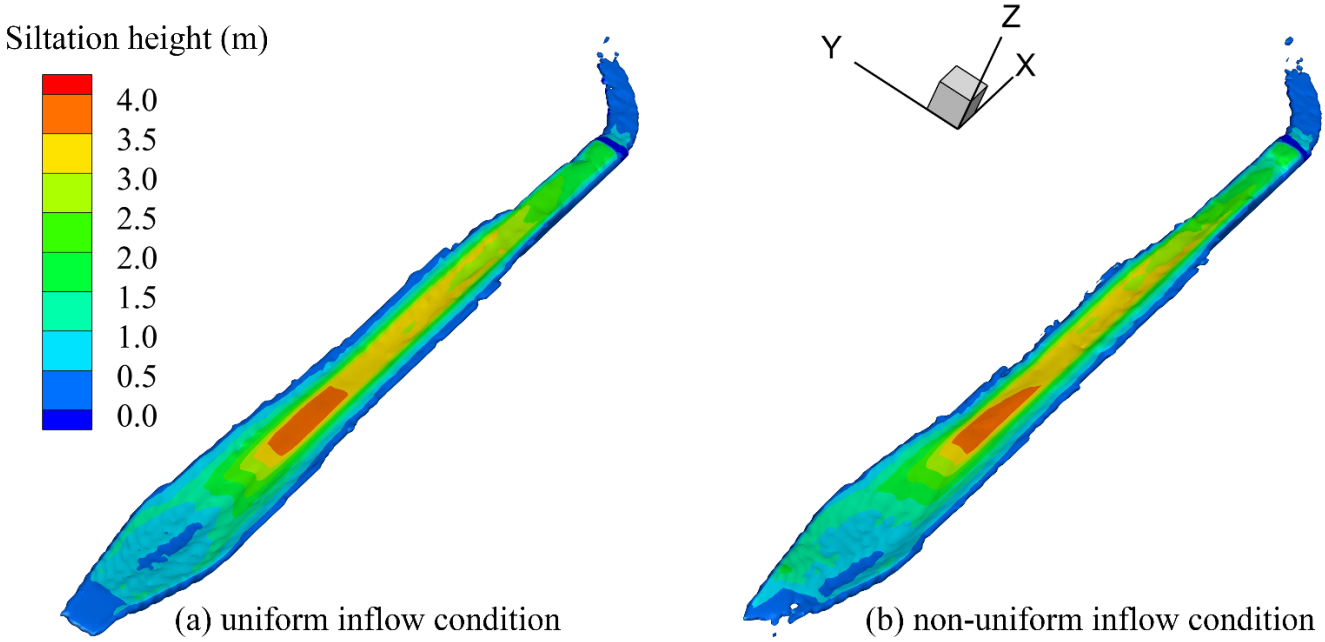


Fig.4 Comparison of deposition patterns under uniform and non-uniform inflow conditions (T = 12 hrs)

Fig.5 ~ Fig.9 shows the deposition efficiency of each particle size group for the two cases. The deposition efficiency of the group d ≥ 0.2 mm is only influenced slightly. For the finer group, the deposition efficiency increase by 3 ~ 5%. As shown in Fig.7(d), the deposition efficiency of the critical size group (d = 0.2 mm) still surpass 90% at the 110 m working section. Therefore, even the non-uniform inflow velocity is considered, the desander basin with 110 m working section length still meet the requirement of 90% removal of the particle coarser than 0.2 mm. The extension of the length of the 'Diffusion section' is unnecessary.

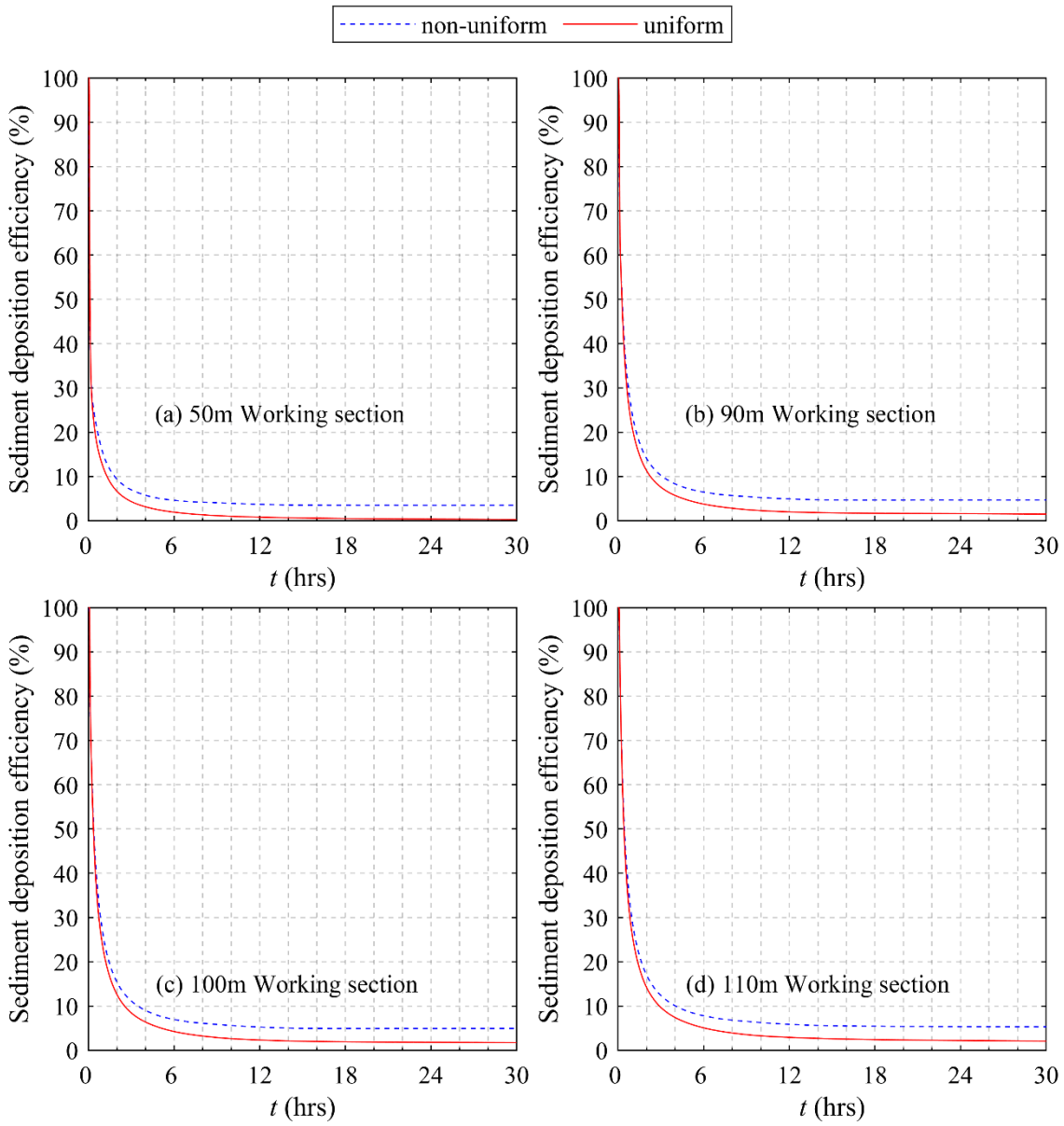


Fig.5 Sedimentation efficiency for particle size group *d* = 0.034 mm under different inflow conditions (diffusion section length 33.5 m & working section length 110 m)

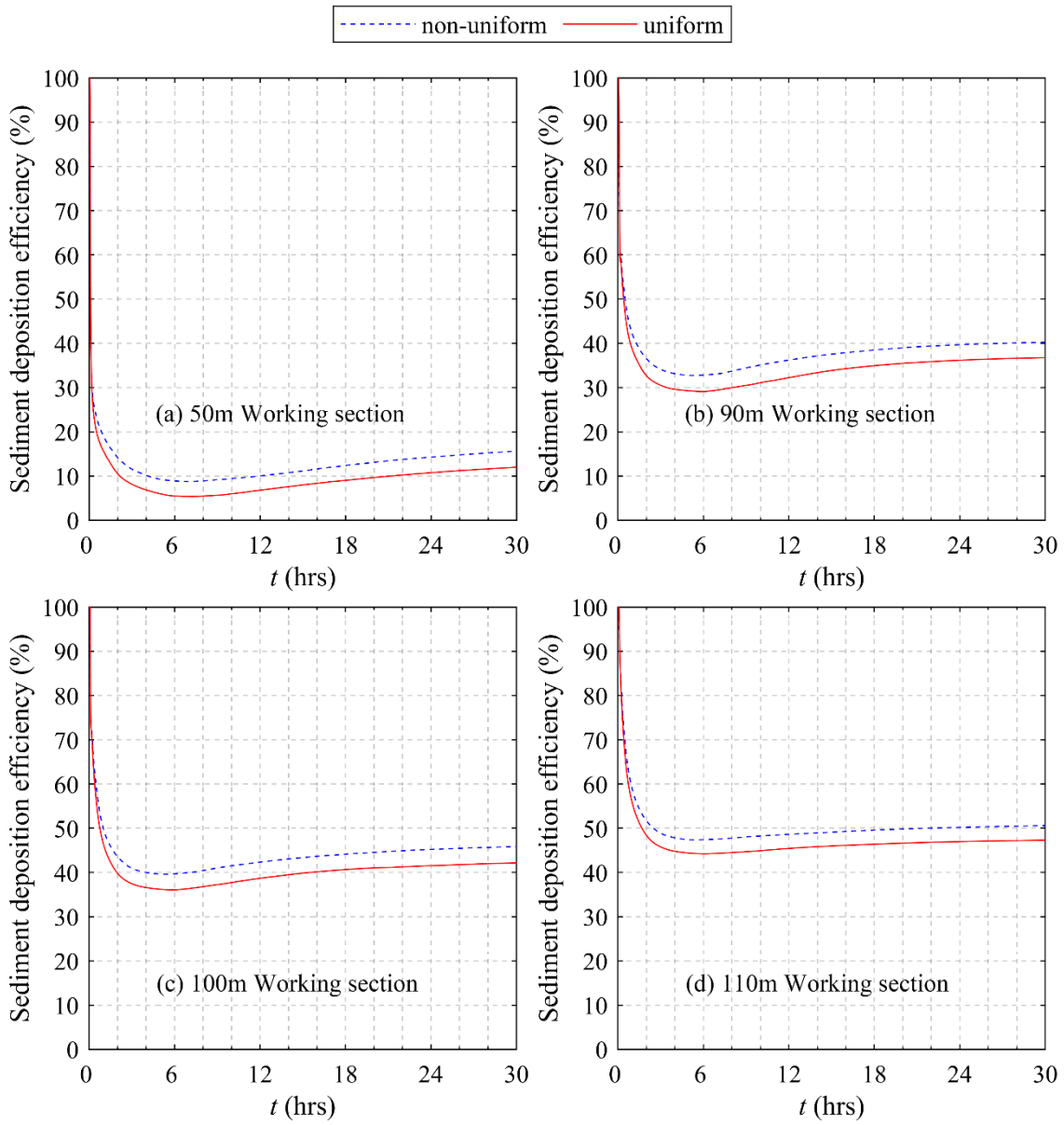


Fig.6 Sedimentation efficiency for particle size group d = 0.106 mm under different inflow conditions (diffusion section length 33.5 m & working section length 110 m)

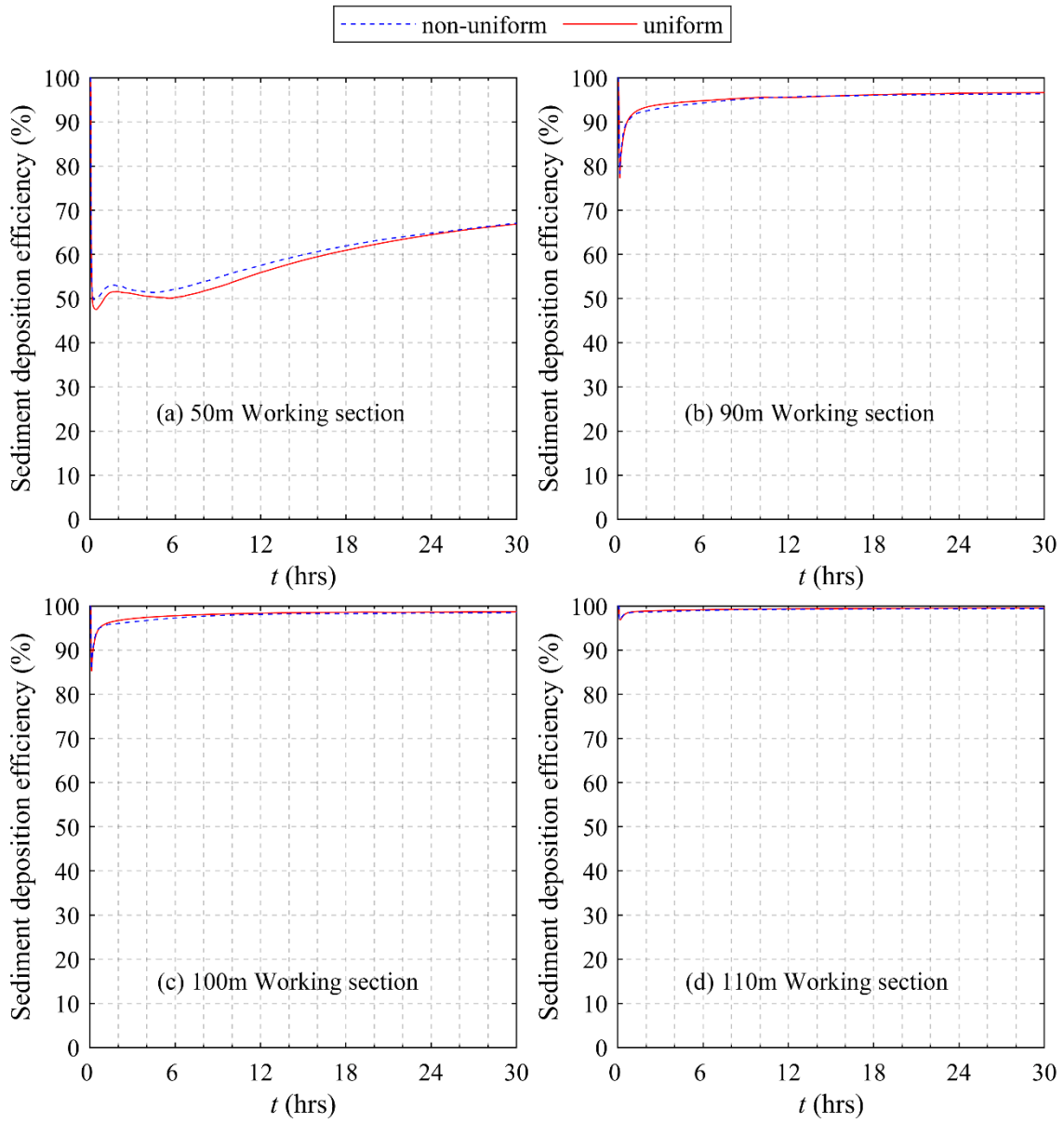


Fig.7 Sedimentation efficiency for particle size group d = 0.20 mm under different inflow conditions (diffusion section length 33.5 m & working section length 110 m)

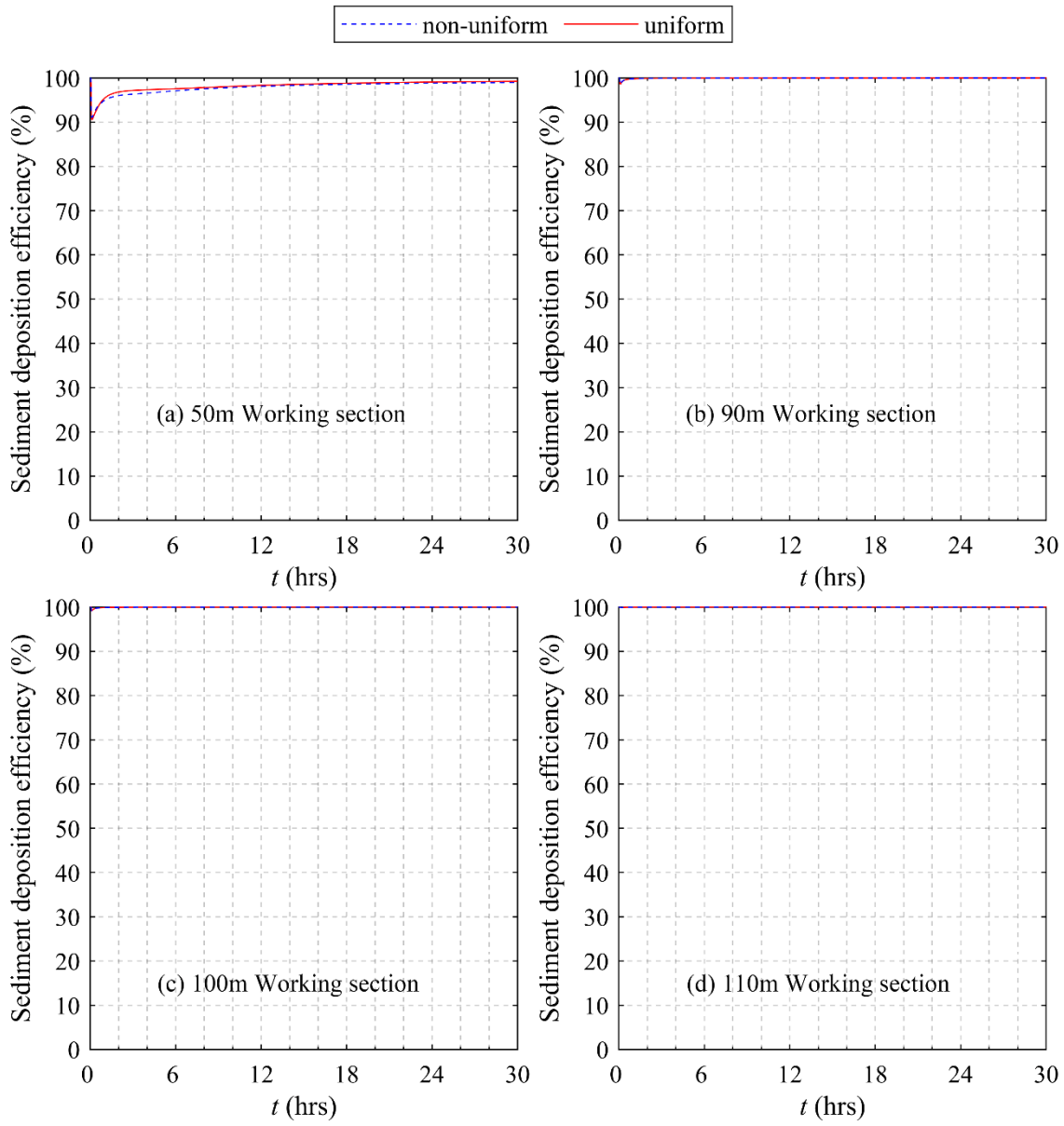


Fig.8 Sedimentation efficiency for particle size group d = 0.375 mm under different inflow conditions (diffusion section length 33.5 m & working section length 110 m)

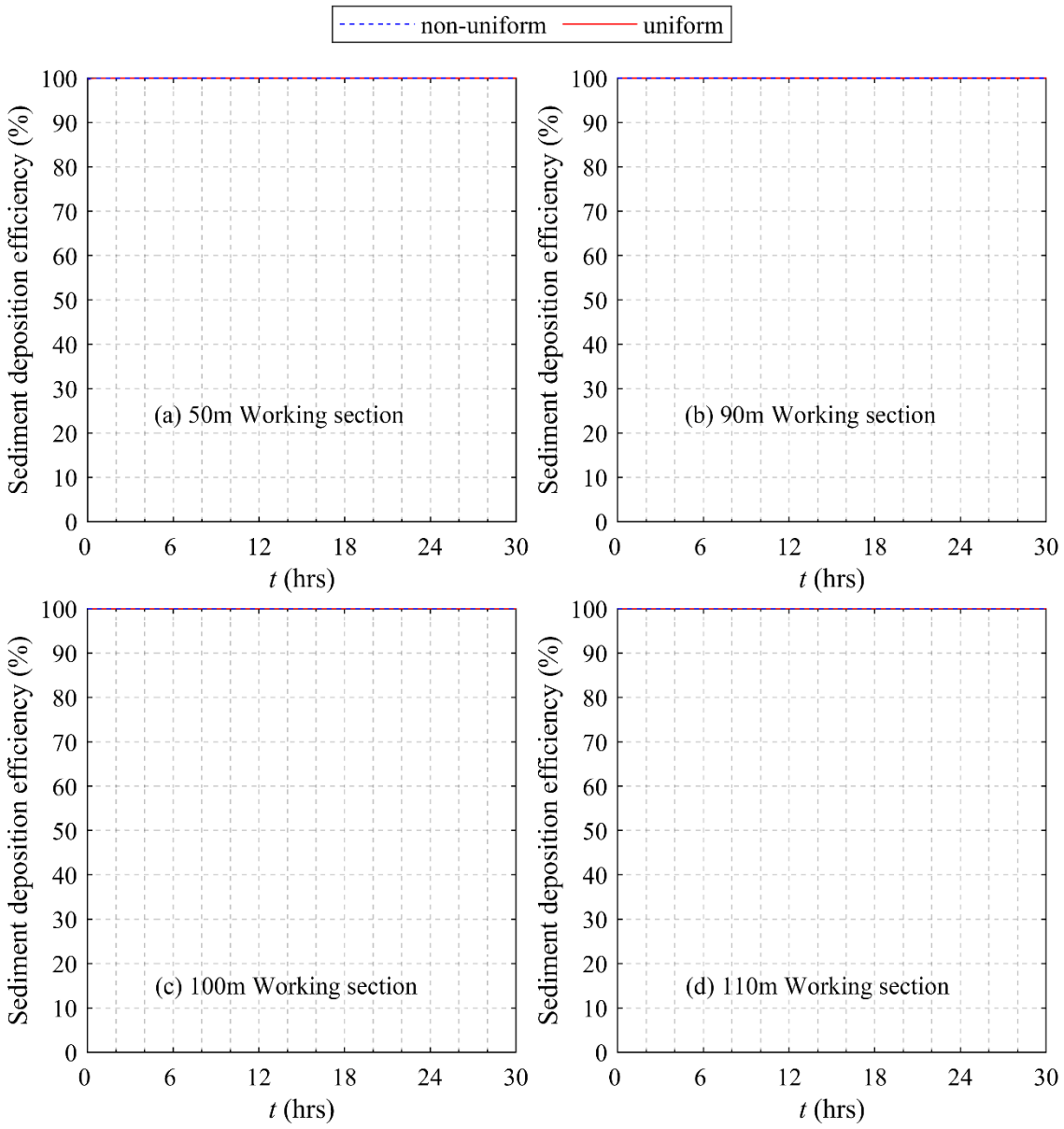


Fig.9 Sedimentation efficiency for particle size group *d* = 0.850 mm under different inflow conditions (diffusion section length 33.5 m & working section length 110 m)

Chapter 7 Conclusions

Para(4) states: "*As per current simulation results, 33.5m long diffusion section and 110m long working sectionare finally proposed*."

Based on the observations stated for the two chapters above OE is of the view that the ''Diffusion section' (transition zone) of the left and right desander basins should be extended in order to allow for achieving a uniform velocity distribution at the inlet section.

The OE is also of the view that the results of the numerical simulation of the sedimentation process are only valid if the velocity distribution in the hydraulic simulation at the initial section of the model shows a quasi-uniform velocity distribution.

The OE is of the view that an **appropriate extension of the length** of the transition zone or **'Diffusion section'** (for the left and right desander basins) is required to achieve uniform velocity distribution. From this point onwards the '33.5 m long diffusion section' should be measured. The actual objective of having this 'diffusion section' at the end of the pressure flow is to achieve uniform flow conditions across the entire cross section for maximising the sediment settling process, and which is a pre-condition for the validity of

the assumptions made for the numerical sedimentation modelling.

Reply: As stated above, a non-uniform inflow condition reflecting the results carried out in the first stage is introduced in the sedimentation calculation and a new case is calculated. Fig.7 ~ Fig.9 shows that the deposition efficiency for the particle size group d ≥ 0.2 mm is well over 90% at the 110m section and the difference between non-uniform and uniform inflow is less than 1%. That is to say, the effect of the non-uniform velocity inflow on the deposition efficiency for the particle size group d ≥ 0.2 mm is less than 1%. For the particle size group d < 0.2 mm, the deposition efficiency increases by 3 ~ 5%. A conclusion that the desander basin with 33.5m diffusion section and 110 m working section in length meet the requirement can be drawn.

Therefore, **an extension of the length of the transition zone or 'Diffusion section'**, which aims to achieve uniform velocity distribution, **is unnecessary**.